

# INTERSIL SPACE PRODUCTS

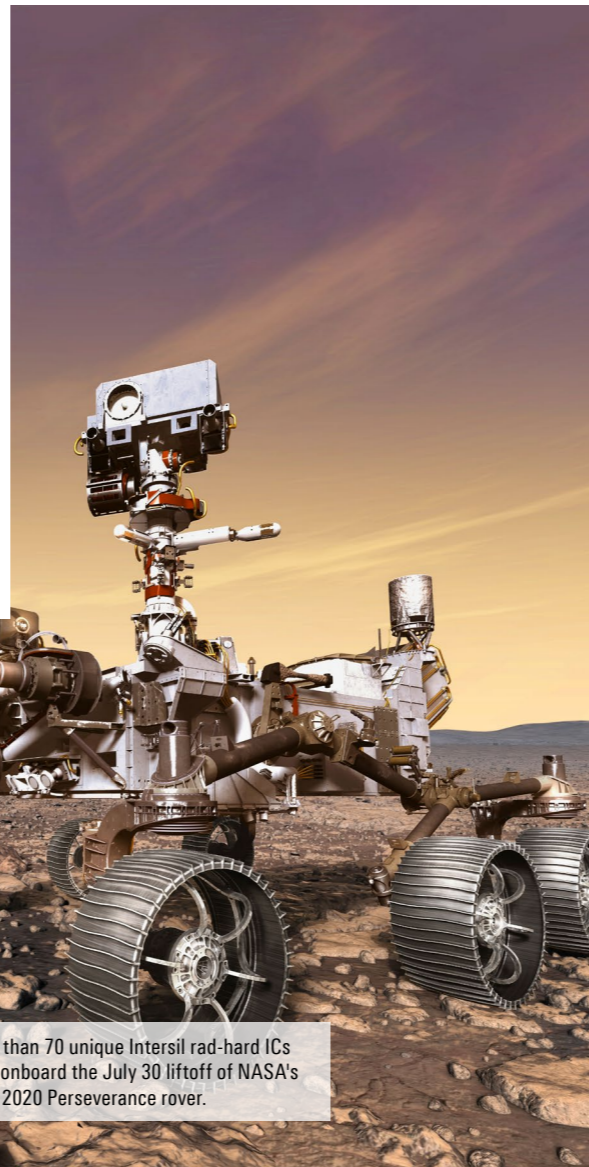
Highly Reliable, Efficient, Accurate Radiation Hardened and Radiation Tolerant ICs



WHEN FAILURE IS NOT AN OPTION™

# INTERSIL SPACE ICs

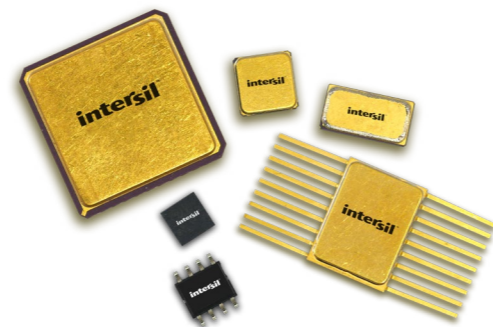
Highly reliable, efficient and accurate radiation-hardened ICs for space applications and other radiation environments.



More than 70 unique Intersil rad-hard ICs were onboard the July 30 liftoff of NASA's Mars 2020 Perseverance rover.

## CONTENTS

- Rad-Hard QML SMD ..... 04
- Rad-Hard and Rad-Tolerant FPGA Power Solutions ..... 05
- Rad-Hard Power ..... 06
- Rad-Hard Analog ..... 08
- Radiation Tolerant Plastic Package ICs ..... 12
- Radiation Hardened Plastic Package ICs ..... 13
- Reference Designs ..... 14
- Space-Grade Products List ..... 16



## Seven Decades of Flight Experience

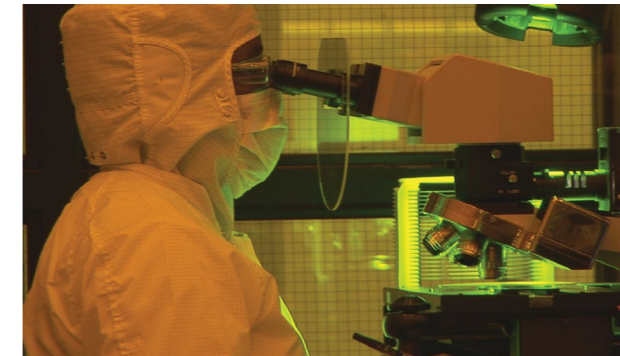
Renesas' (formerly Intersil) history and experience in the space and defense industries spans almost seven decades beginning with the founding of Radiation, Inc. in 1950. Today, we continue to support and release new SMD-based, Class-V/Q radiation hardened (rad-hard) products for Hi-Reliability, and Space marketplaces.

The low dose rate ionizing dose response of semiconductors has become a key issue in space applications. We are addressing this changed market with wafer-by-wafer low dose rate acceptance testing as a complement to current high dose rate acceptance testing.

All of our SMD products are MIL-PRF-38535/QML compliant and are 100% burned in.

By leveraging our latest technology for the consumer marketplace, Intersil space products group is releasing Class V/Q products that are revolutionizing the Hi-Reliability and Space marketplaces.

## Intersil Space IC Benefits



### Highest Standards

As a major supplier to the military and aerospace industries, our Intersil product development methodologies reflect experience designing products to meet the highest standards for reliability and performance in challenging environments. Intersil products can be found in virtually every satellite sent into space.

- All products are MIL-PRF-38535/QML compliant
- All products are 100% burned in
- Consistent design and manufacturing in our MIL-PRF-38535-qualified facility in Palm Bay, Florida
- We are one of only a few RHA Defense Logistics Agency (Land and Maritime) QML suppliers
- All products are fully Class V (space level) compliant
- All products are on individual DLA SMD drawings

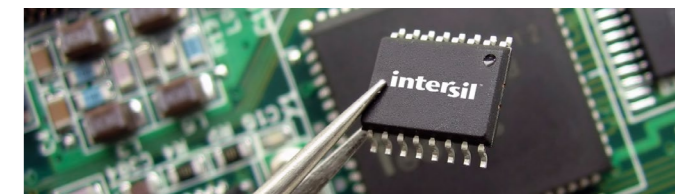
### Reliable, Proven Supply Chain

Proven proprietary processes and package technologies, shipping over 1 billion ICs per year.

- Strong technology development
  - Proprietary process and package technologies
- Multi-sourcing strategy
  - Sourcing from multiple leading-edge semiconductor foundries & assembly/test partners ensures a steady product supply and reduced risk
- Industry-leading quality & reliability metrics
  - Billion+ ICs shipped every year
  - Less than 1.0 DPPM (defective parts per million) and improving
  - Decades of experience handling military/space products and delivering world-class quality and reliability metrics
  - ISO/TS16949 and AEC-Q100
  - MIL-PRF-38535 compliant and 100% burned in

### Assured Product Supply

Long life cycles ensure steady flow of product. We still support customer programs with products in production for over 40 years.



# RAD-HARD QML SMD

## STANDARD DATA PACKAGE

Nomenclature, Example	Class Q		Class V		
	RH Packaged Part	RH Packaged Part	EH Packaged Part	RH Die - Authorized Die Processors Only	EH Die - Authorized Die Processors Only
Part Types	"RH-8" "RHQ" XXXXRH-8 in the part #	"MSR" "NSR" "RHV" "RH-Q" XXXXRH-Q in the part #	"EHV" "EH-Q" XXXXEH-Q in the part #	HS0-XXXXRH-Q ISO-XXXXRH-Q ISL7XXXXRHVX "HSR" or "HMSR" in the part #	HS0-XXXXEH-Q ISO-XXXXEH-Q ISL7XXXXEHVX in the part #
Shipper/Pack Slip	X	X	X	X	X
P.O. Number	X	X	X	X	X
Customer Part Number, Rev (as applicable on the P.O.)	X	X	X	X	X
Intersil Part Number	X	X	X	X	X
Lot Date Code / Trace Code	X	X	X		
Lot Number	X	X	X	X	X
Quantity	X	X	X	X	X
Certificate of Conformance	X	X	X	X	X
Screening Attributes Data		X	X	X	X
Post seal thru end of 100% screening operations		X	X		
Test Operations		X	X		
Test Methods		X	X		
Quantity of units in/out by operation		X	X		
Date of each test		X	X		
PDA as applicable		X	X		
Visual Inspection		X	X	X	X
Document Review		X	X	X	X
Screening Variables & Delta Data - Variables data for all read/record and/or delta operations pre/post burn-in @25°C are provided on electronic media.		X	X		
Group A Attributes (located in Screening Attribute Data if performed)		X	X		
Group B Attributes Summary		X	X		
Group C Attributes Summary		X	X		
Group C Variables & Delta Data - Variables data for all read/record and/or delta operations pre/post life test are provided on electronic media.			X		
Group D Attributes Summary		X	X		
Group E Variables Data for HDR & LDR - Variables data for all read/record operations pre/post rad are provided on electronic media.			X		X
SEM C of C & Photos (if performed)		X	X	X	X
Radiation C of C (High Dose Rate and/or Low Dose Rate)	HDR	HDR	HDR & LDR	HDR	HDR & LDR
X-Ray Report (Film kept on file and available on request. Request must be documented on P.O.)		X	X		

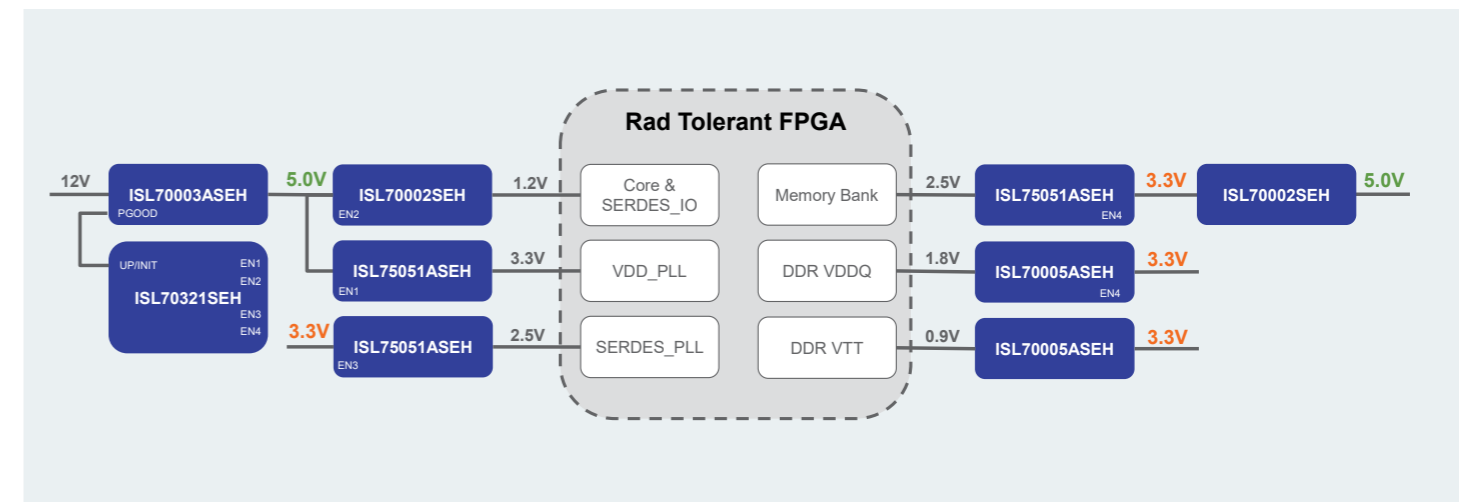
★ All EH product shipments will now come with Group C and E variables data in the data package.

# RAD-HARD AND RAD-TOLERANT FPGA POWER SOLUTIONS

Due to their flexibility in design and cost effectiveness compared to ASICs, FPGA-based systems have become increasingly common in space applications as the requirement to do more on-board processing is increasing.

Equally important is the power solution of these multi-rail digital loads. The power supply must be stable and efficient even in the harsh environments of space, which includes total ionizing dose and single event effects. Couple-in the need for a smaller, light-weight power solution and you will find us at the forefront developing leading edge point-of-load (POL) regulators that meet the demands to power these high performance FPGA's.

## POWER SOLUTION FOR RADIATION TOLERANT FPGA



## Switching Regulators

Part Number	Description	V <sub>IN</sub> Range	Switching Frequency	SYNC Capable	Current Sharing	High Dose Rate (HDR)	Low Dose Rate (LDR)	SEL (MeV.cm <sup>2</sup> /mg)	Qualification Level
ISL70001ASEH	6A, Rad-Hard Sync Buck Converter	3 - 5.5V	1MHz	Yes	No	100krad(Si)	50krad(Si)	86.4	QML Class V
ISL70002SEH	18A, Rad-Hard Sync Buck Converter	3 - 5.5V	500kHz/1MHz	Yes	Yes	100krad(Si)	50krad(Si)	86.4	QML Class V
ISL70003ASEH	9A, Rad-Hard Sync Buck Converter	3 - 13.2V	300kHz/500kHz	Yes	No	100krad(Si)	50krad(Si)	86.4	QML Class V
ISL70005SEH	Rad-Hard Dual Output Point-of-Load, Int. Sync Buck and Low Dropout Regulator	3 - 5.5V	100kHz - 1MHz	Yes	No	100krad(Si)	75krad(Si)	86.4	QML Class V

## Low Dropout Regulators

Part Number	Description	V <sub>IN</sub> Range	Dropout @ 1A	Output Option	Quiescent Current	High Dose Rate (HDR)	Low Dose Rate (LDR)	SEL (MeV.cm <sup>2</sup> /mg)	Qualification Level
ISL75051ASEH	3A, Rad-Hard, Positive, Ultra-Low Dropout Regulator	2.2 - 6V	65mV	Adjustable	11mA	100krad(Si)	50krad(Si)	86.4	QML Class V
ISL73051ASEH	3A, Rad-Hard, Positive, Ultra-Low Dropout Regulator	2.2 - 6V	65mV	Adjustable	11mA	N/A	50krad(Si)	86.4	QML Class V

## Power Supply Sequencers

Part Number	Description	V <sub>IN</sub> Range	Quiescent Current	Rising/Falling Delay	PGOOD Timer	High Dose Rate (HDR)	Low Dose Rate (LDR)	SEL (MeV.cm <sup>2</sup> /mg)	Qualification Level
ISL70321SEH	Rad-Hard Quad Power Supply Sequencers	3 - 13.2V	3.5mA	2 - 20ms	4 - 40ms	100krad(Si)	75krad(Si)	86.4	QML Class V
ISL73321SEH	Rad-Hard Quad Power Supply Sequencers	4 - 13.2V	3.5mA	2 - 20ms	4 - 40ms	N/A	75krad(Si)	86.4	QML Class V

Radiation Hardened

# RAD-HARD POWER

Radiation Hardened GaN Power Solutions

Robust Power Solutions for High Performance FPGAs and ASICs

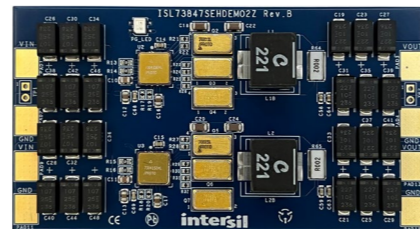
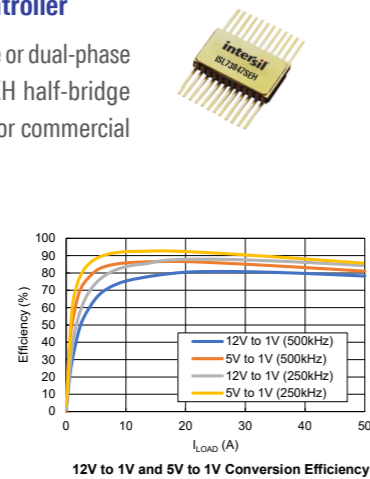
The ISL73847SEH, ISL73041SEH and ISL70020SEH work together to create a robust and precise power solution for high performance FPGAs and ASICs.

ISL73847SEH: Rad-Hard Dual Output PWM Controller

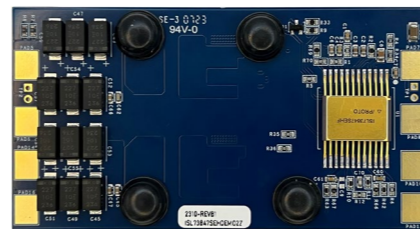
A synchronous buck controller that can operate as a single or dual-phase controller. It is intended to work with the ISL73041SEH half-bridge GaN FET driver to generate Point-Of-Load voltage rails for commercial space applications.

- Single- or Dual-phase
- 4.5V to 19V input voltage range
- Output voltage as low as  $V_{REF}$ : 0.6V +/- 0.67%
- Differential remote sensing of output voltage
- 24 Ld hermetically sealed Ceramic Dual Flatpack (CDFP) package

See specs in "Switching Controllers" on page 22



ISL73847SEHDEMO2Z Evaluation Board (Top)



ISL73847SEHDEMO2Z Evaluation Board (Bottom)

ISL73041SEH: GaN FET Half-Bridge Drivers

The ISL73041SEH an extremely flexible half bridge GaN FET driver with precise deadtime control and well matched propagation delays between the high side and low side. It is also capable of driving multiple parallel GaN FETs to take advantage of lower conduction losses and features boot overvoltage protection to ensure that the boot voltage never exceeds the abs max of the GaN FET.

- Interfaces with ISL73847SEH synchronous buck controller
- Programmable gate drive, 4.5V to 5.5V
- Highly matched, fast propagation delays between high- and low-side drivers
- Wide VDD input voltage range, up to 13.2V
- 16 Ld Ceramic Leadless Chip Carrier (CLCC) hermetic package

See specs in "GaN FET Drivers" on page 21



ISL70020SEH: GaN Power Transistors

The ISL70020SEH is a 40V GaN FET that is ideal for this application due to its extremely low  $r_{DS(ON)}$ .

- 40V N-channel enhancement mode GaN power transistors
- Very low  $r_{DS(ON)}$  3.5mΩ (typical)
- Ultra low total gate charge 19nC (typical)
- Ultra small hermetically sealed 4 Ld Surface Mount Device (SMD) package
  - Package area: 42mm<sup>2</sup>

See specs in "GaN FETs" on page 20



ISLVERSALDEMO2Z

Complete Power Management Solution for AMD Space-Grade Versal™ Adaptive SoC

ISLVERSALDEMO2Z is an easy to use rad hard reference design that includes all the power management needed for the AMD Xilinx Space Grade Versal ACAP AI Core VC1902.

For ordering information, schematics, GERBER files and more, visit [renesas.com/islversaldemo2z](https://renesas.com/islversaldemo2z)

See more information on page 15.

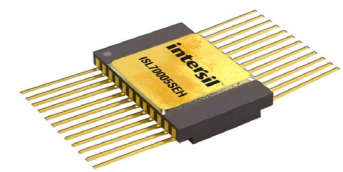
Synchronous Buck and Low Dropout Regulator

Monolithically Integrated ISL70005SEH Space-Grade Power Solution Reduces BOM Count and Size, Weight and Power for FPGAs and DDR Memory

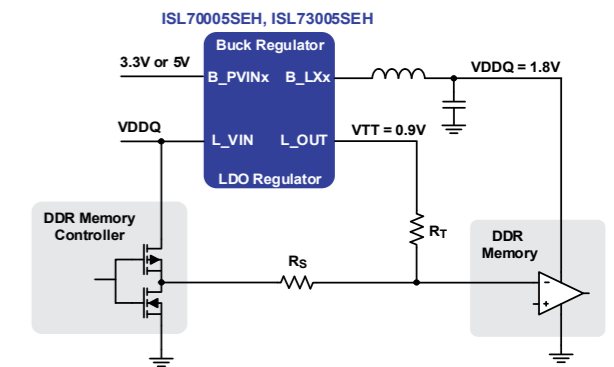
The ISL70005SEH is the only point-of-load (POL) power solution that reduces size, weight, and power (SWaP) by integrating a synch buck and LDO in one monolithic IC. The device enables satellite manufacturers to reduce bill of materials (BOM) and power supply footprint for their medium Earth orbit (MEO) and geosynchronous Earth orbit (GEO) long duration mission profiles.

Features

- Synchronous buck  $V_{IN}$  range of 3V to 5.5V
- LDO  $V_{IN}$  range of 600mV + VDO to  $V_{cc}$ -1.5V
- 1% reference voltage accuracy
- Separate  $V_{IN}$ , enable, soft-start and power good indicator
- LDO stable with 150μF; 3x less output capacitance than competitive solutions
- Full military temperature range of -55°C to +150°C
- 28 Ld ceramic dual flat-pack package



Power Solution for DDR2 Memory



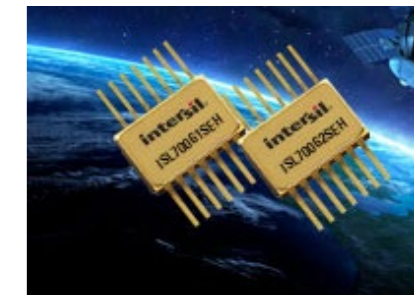
NMOS and PMOS Load Switches

Radiation Hardened 10A PMOS Load Switch

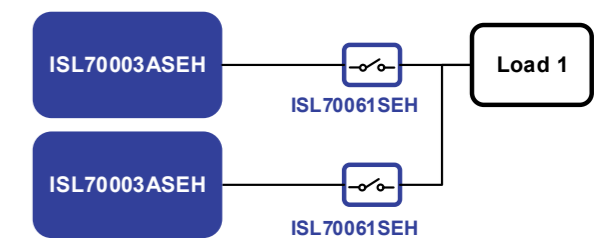
The ISL70061SEH is a radiation hardened single channel load switch featuring ultra-low  $r_{ON}$  and controlled rise time. The ISL70061SEH device uses a PMOS and the ISL70062SEH device uses a NMOS pass device as the main switch that operates across an input voltage range. Both devices can support a maximum of 10A continuous current. Simple ON/OFF digital control inputs make the device capable of interfacing directly with low voltage control signals from a FPGA, MCU, or processor.

Features

- Integrated high speed load switch
  - Turn-off time of 3μs
- Ultra-low ON-resistance ( $r_{ON}$ ) of 14mΩ typical (ISL70061SEH)
- Continuous 10A switch current
- Controlled rise time to minimize inrush current
- Reverse current protection
- Simple ON/OFF logic control
- Undervoltage lockout
- Selectable 122Ω discharge MOSFET
- QML Class V Qualification



Redundant Source Switch Application



Load Switch Family

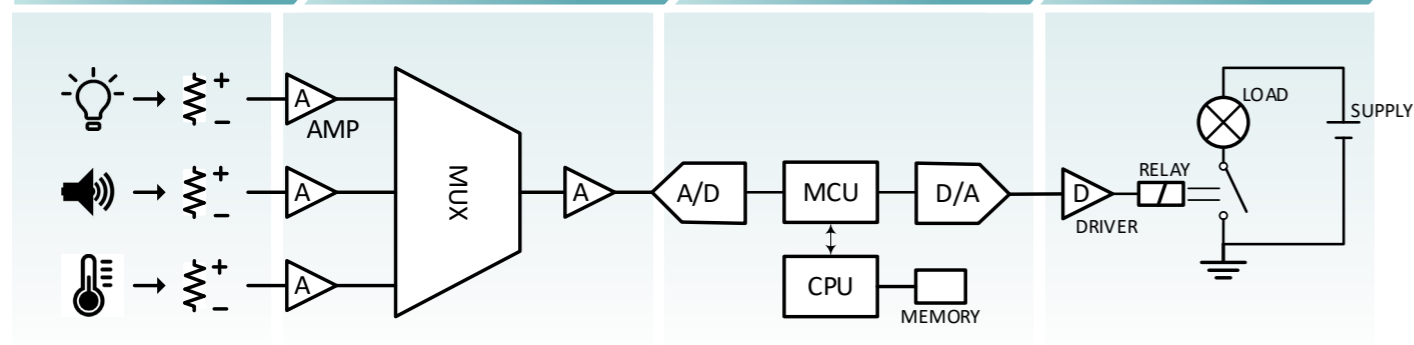
Part Number	FET Pass Device Type	Input Voltage Range (V)	Vcc Range (V)	Continuous Output Current (A)	Ron (mΩ) Typ	Iq (μA) Typ	Class	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Qualification Level	Temp Range (°C)	Package Type
ISL70062SEH, ISL73062SEH	NMOS	Vcc - 2	3 - 5.5	10	25	0.76	V, /PROTO	75	86	QML Class V (space)	-55 to +125	14pin-CFP
ISL70061SEH, ISL73061SEH	PMOS	3 - 5.5	-	10	14	31	V, /PROTO	75	86	QML Class V (space)	-55 to +125	14pin-CFP

Radiation Hardened

# RAD-HARD ANALOG



## LEADERS IN ANALOG SIGNAL PROCESSING



For over 70 years, Renesas has been an industry leader offering the most comprehensive selection of leading-edge QML Class V products for signal processing applications. These fundamental building blocks provide the reliability, accuracy and precision required in Command & Telemetry; Thermal Control; Altitude Control; Imaging and many other satellite subsystems.

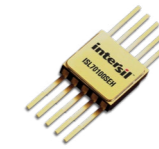
All subsystems employing analog signal processing can be reduced to four fundamental functions:

- SENSE** Sensors convert parameters such as temperature, pressure, light, sound, etc. to an electrical signal.
- CONDITION** The signal is amplified and filtered. In multi-sensor systems, a multiplexer allows sampling each source in repeated intervals.
- CONVERT & COMPUTE** Digital conversion, movement, storage and processing of the data occur. Resultant data is converted back to an analog signal.
- ACTUATE** The system performs an action, such as driving relays or switches, based on the results.

### SENSE

#### Current Sense Amplifiers

##### Amplifier Specifically Designed for Current Sensing Application



##### ACCURATE - Ultra-low input offset voltage

The ISL70100SEH has an ultra-low input offset voltage specification of 10µV (typical) at 25°C, allowing designers to achieve their required accuracy without increasing the sense resistor value and wasting unnecessary power.

##### RELIABLE - Can monitor currents from a 28V bus voltage

The input common mode voltage range is -0.3V to 40V independent of the power supply used to bias the CSA. This allows the user to power the CSA from 3.3V, but monitor currents from a 28V bus voltage.

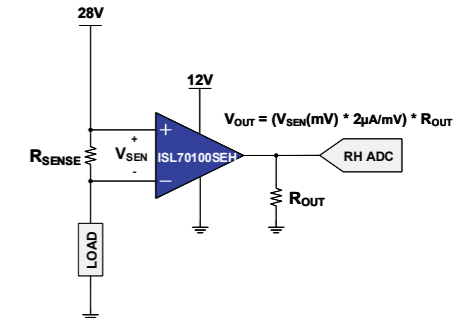
##### SIMPLE - Only one additional resistor is required

Besides the sense resistor, only one additional resistor on the output is required to set the overall gain of CSA. This eliminates the need for external output-to-input gain resistors, thus reducing component count and board space.

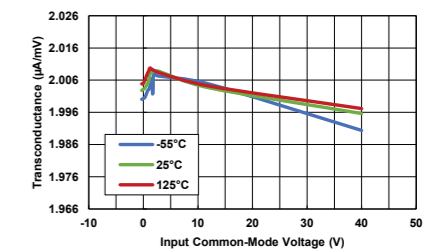
#### Features

- Power supply range: 2.7V to 40V
- Input common-mode range: -0.3V to 40V
- Transconductance: 2µA/mV (typical)
  - ±1% accuracy (T<sub>A</sub> = 25°C)
  - ±1.5% accuracy (T<sub>A</sub> = -55°C, 125°C)
- Voltage offset: 10µV (typical), V<sub>+</sub> = 12V
- Adjustable gain with a single resistor

#### Typical Application: High-Side Current Sense for 28V Supply Rail



#### Transconductance, V<sub>+</sub> = 12V



Part Number	V <sub>S</sub> Range	I <sub>S</sub> (per amp)	BW	Features	Max Offset Voltage	Common Mode Input Range	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package Type
ISL70100SEH	2.7 to 40V	250µA	500kHz	Low/High Side Capable	400µV	-0.3 to 40V	100	75	86.4	-55 to +125	V, /PROTO	QML Class V (space)	10pin-FP
ISL73100SEH							N/A						

### Temperature Sensors

#### Radiation Hardened Temperature Sensor

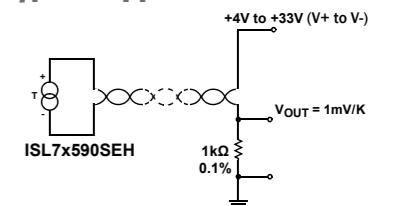


The ISL71590SEH and ISL73590SEH are temperature-to-current transducers possessing two terminals. They have a high impedance current output that allows them to be insensitive to voltage drops across long lines. When provided a differential voltage between 4V and 33V, the devices act as constant current regulators that generate a current equal to 1µA/Kelvin (K).

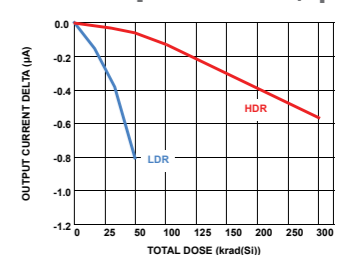
#### Features

- Wide operating supply range: 4V to 31V
- Linear output current: 1µA/K
- High ESD level: 3kV HBM
- ±1.7°C absolute error from -55°C to +125°C
- < -1°C error over radiation
- High output impedance to reject variations in supply
- SOI process to eliminate single event latch-up
- Best-in-class radiation performance

#### Typical Application



#### Linear Output Current (1µA/K)



Part Number	Linear Output Current	Power Consumption	Ambient Error Accuracy	PSRR	HDR krad(Si)	LDR krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package Type
ISL71590SEH	1µA/K	1.5mW	-0.05°C	0.10µA/V	300	50	86.4	-55 to +125	V, /PROTO	QML Class V (Space)	2pin-FP
ISL73590SEH					N/A						

CONDITION

Multiplexers

5V Multiplexers Provide Industry's Best ESD Protection and Signal Processing Performance

The ISL71830SEH (16-ch) and ISL71831SEH (32-ch) are radiation tolerant, single supply 5V multiplexers. The 5V multiplexers address the growing trend toward reduced system voltage rails. They provide data acquisition systems with the industry's best electrostatic discharge (ESD) protection, and deliver lower  $R_{ON}$  and input leakage for reduced power consumption and higher signal integrity.

Features

- 3V to 5.5V single supply operation with adjustable logic threshold control
- Delivers 5kV human body model (HBM) ESD protection
- Rail-to-rail switch input provides wide dynamic range for extra design flexibility
- Over-voltage shutoff protects upstream/downstream devices when a switch goes 1V-2V past the rails
- Cold sparring and analog overvoltage range from -0.4V to 7V
- Switch input off leakage of 120nA and low  $R_{ON}$  of 120Ω (max) reduces power consumption, and improves signal integrity

Part Number	Channels	$r_{DS(ON)}$ (Ω) Typ	Input Voltage Range (V)	ELDRS krad(Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temperature Range (°C)	Class	Qualification Level	Package Type
ISL71830SEH	16	40	3 – 5.5	75	60	-55 to +125	V, /PROTO	QML Class V (Space)	28pin-CDFP
ISL71831SEH	32	40	3 – 5.5	75	60	-55 to +125	V, /PROTO	QML Class V (Space)	48pin-CQFP

CONVERT & COMPUTE

AD Converters

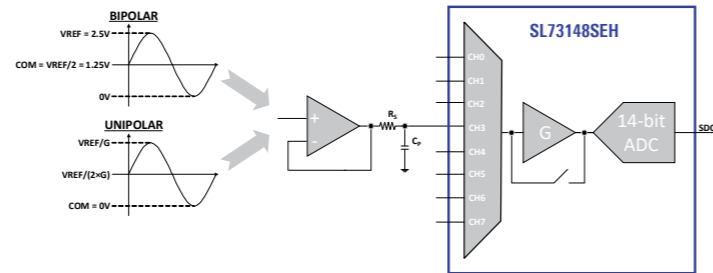
Rad-Hard 8-Channel 14-Bit 900/480kSPS SAR ADC with Integrated PGA

The ISL73148SEH has the best-in-class performance, including low noise, high-resolution, and excellent linearity. It operates on a 5V supply, with an independent supply for the digital interface, allowing for a high level of interoperability with MPU/MCU/FPGA.

Features

- Low noise: 82dBFS (PGA bypassed), 77dBFS SNR (PGA Gain = 2)
- High resolution: 14-bit resolution with 13.4-bit ENOB
- Excellent linearity: ±0.5 LSB DNL, ±1.5 LSB INL
- Integrated 8-channel MUX and PGA
  - Pin programmable channel and gain setting selection
  - Reduces external components and cost
- High precision to meet the accuracy requirements of next-gen payloads

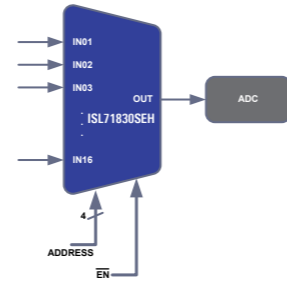
Typical Application Example Circuit



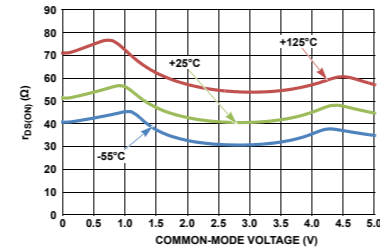
Part Number	Product Title	Channels (#)	Resolution (bits)	Conversion Rate (Max) (kSPS)	Power Consumption (mW)	Analog Supply Voltage (V)	Integral NonLinearity LSB	Differential NonLinearity LSB	Package Type
ISL73141SEH	Rad-Hard 14-Bit 1MSPS SAR ADC	1	14	1000	28	3 - 5.5	0.5	0.2	14 Ld CDFP
ISL73148SEH	Rad-Hard 14-Bit 900kSPS SAR ADC w/ Int. PGA	8	14	960	90	5	1	0.5	28 Ld CDFP

For more detail specifications, refer to "AD Converters" on page 17

Typical 16-channel Multiplexer Application



Very Low  $r_{DS(ON)}$  Allows for Improved Signal Integrity and Reduced Power Losses



$r_{DS(ON)}$  vs Common-Mode Voltage ( $V+ = 5V$ )

ACTUATE

Source Drivers

ISL72813SEH: Single-Chip Rad Hard 32-Channel Driver with Integrated Decoder for Satellite Applications Reduces Command and Telemetry Solution Size by 50%

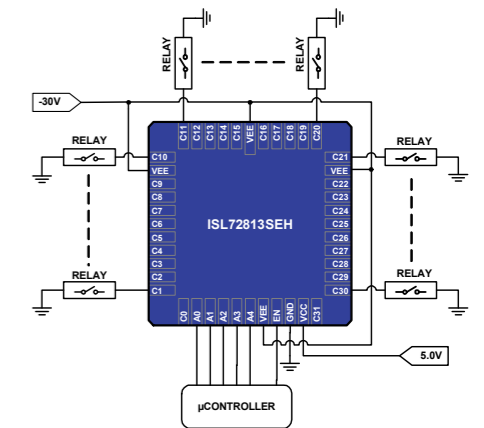
The ISL72813SEH is the industry's first high current driver to integrate the decoder, level shifter and driver array in a single monolithic IC, allowing satellite manufacturers to significantly increase system capacity and reduce solution size by up to 50%. The device offers a 4x higher density channel count compared to the nearest competitor, and the integrated level shifter eliminates several peripheral components.

Features

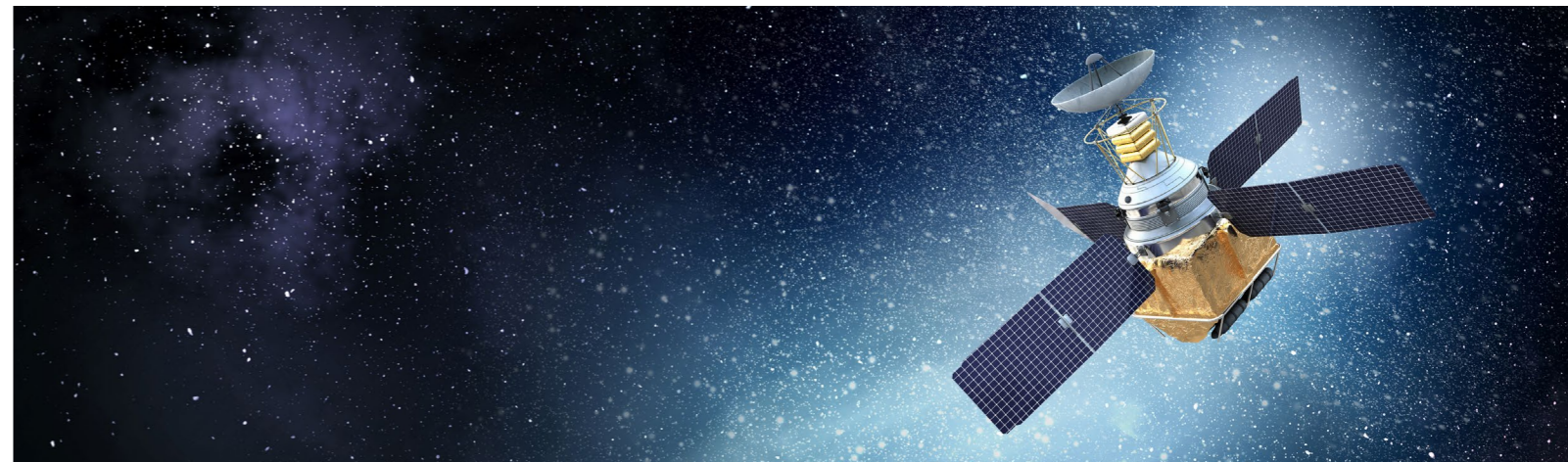
- Acceptance tested to 50krad(Si) LDR, wafer-by-wafer
- Integrated 5-bit to 32-channel decoder and level shifting circuit
- High collector current outputs to 600mA
- Low  $V_{CE}$  saturation of 1.5V with IC of 530mA
- High voltage outputs up to -40V
- $V_{CC}$  supply range of 3V to 5.5V
- Extended operating temperature range of -55°C to +125°C
- HDR radiation tolerance of 100krad(Si) and LDR of 50krad(Si)
- SEB  $LET_{TH}$  ( $V_{CE} = 33V$ ) immune up to 86.4MeV•cm<sup>2</sup>/mg



Typical Application



Part Number	Output Channels	Max Channel Voltage	Integrated Decoder	Output Saturation Voltage @350mA	Class	HDR krad(Si)	ELDRS krad(Si)	SEL (MeV/mg/cm <sup>2</sup> )	SEB (MeV/mg/cm <sup>2</sup> )	Qualification Level	Temperature Range (°C)	Package Type
ISL73814SEH	16	42V	Yes	1.3V	V, /PROTO	N/A	75	SEL free	86	QML Class V (space)	-55 to +125	28pin-CFP
ISL72814SEH	16	42V	Yes	1.3V	V, /PROTO	100	75	SEL free	86	QML Class V (space)	-55 to +125	28pin-CFP
ISL72813SEH	32	42V	Yes	1.4V	V, /PROTO	100	50	SEL free	86	QML Class V (space)	-55 to +125	44pin-CLCC



Space-Grade Plastic Packages

# RADIATION TOLERANT PLASTIC PACKAGE ICs



## Cost Effective Solutions for Short Duration Low Earth Orbit (LEO) Mission Profiles

The ISL71xxxM family of radiation-tolerant plastic-package ICs is designed to support the emerging field of small satellites that will provide solutions such as high-speed Internet connections to hundreds of millions of users in communities, governments, and businesses worldwide. Fleets of hundreds of small satellites will create mega-constellation networks to deliver broadband Internet links from low Earth orbit (LEO) to every corner of the globe, including rural areas without wireless connectivity access.

Our rad-tolerant plastic packaging flow leverages the company's more than 60 years of spaceflight experience developing rad-hard (>75krad) and rad-tolerant (<75krad) products for extremely harsh environments. The upfront radiation effects characterization and AEC-Q100 automotive-like qualification give customers the utmost confidence to design Intersil radiation-tolerant plastic parts into cost-sensitive small satellites for LEO mission profiles up to five-years. The ISL71xxxM are also well suited for high altitude (>40km) avionic systems, launch vehicles that are prone to heavy ions, and medical equipment where radiation is a concern.

Rad-Tolerant Analog

Multiplexers	
ISL71030M	Radiation Tolerant 16-input, 3V-5.5V Multiplexer
CAN Bus Transceiver	
ISL71026M	3.3V CAN Transceiver, 1Mbps, Listen Mode, Loopback
Operational Amplifiers	
ISL71444M	40V Quad Rail-to-Rail Input-Output, Low-Power Op Amp
ISL71218M	Dual 36V Precision, Rail-to-Rail Output, Low-Power Op Amp
Voltage References	
ISL71010B25	Ultra-Low Noise, 2.5V Precision Voltage Reference
ISL71010B50	Ultra-Low Noise, 5V Precision Voltage Reference

Rad-Tolerant Digital

Digital Isolators	
ISL71610M	Radiation Tolerant Passive-Input Digital Isolator
ISL71710M	Radiation Tolerant Active-Input High Speed Digital Isolator

Rad-Tolerant Power

PWM Controller	
ISL71043M	Radiation Tolerant Single-Ended Current Mode PWM Controller
ISL71041M	Radiation Tolerant Single-Ended Current Mode PWM Controller
Switching Regulator	
ISL71001M	6A Synchronous Buck Regulator with Integrated MOSFETs
GaN FET Driver	
ISL71040M	Radiation Tolerant Low-Side GaN FET Driver

# RADIATION HARDENED PLASTIC PACKAGE ICs



## Save Up to 50% of Board Area While Maintaining the Reliability and Radiation Assurance for Higher Orbit Missions

Renesas' Intersil plastic-packaged radiation-hardened devices are optimized for satellite power management systems. Combining rad-hard assurance levels with the board area savings and cost advantages of plastic packaging, the new portfolio brings space grade solutions to MEO/GEO missions with longer lifetime requirements, as well as small satellites (smallsats) and higher density electronics, while reducing size, weight, and power (SWaP) costs.

**ISL73033SLHM**  
100V Low Side GaN Driver + FET



81 ball 8x8mm BGA

- Combines world-class GaN FET driver and GaN FET in a single package to simplify gate design and improve efficiency
- Reduces area size by 20% compared with an SMD 0.5 rad-hard MOSFET
- $V_{DS} = 100V$  &  $I_{DS} = 30A$  with  $7.5m\Omega$  (typ)  $R_{DS(on)}$
- Ultra low total gate charge: 14nC (typ)

**ISL71001SLHM/SEHM**  
6A Sync Buck Regulator



64 Ld 12x12mm TQFP

- 6A synchronous POL regulator enables high power conversion efficiency in a smaller package
- Highly efficient: 95% peak efficiency
- Fixed 1MHz switching frequency
- Adjustable output voltage

**ISL71610SLHM**  
Passive Input Digital Isolator



8 Ld 5mm x 4mm SOIC

**ISL71710SLHM**  
Active Input Digital Isolator



- Giant Magneto Resistive (GMR) isolation technology delivers better radiation tolerance compared with existing space grade optocouplers on the market
- 2.5kV<sub>RMS</sub> Isolation
- Up to 100Mbps data rates for the ISL71610SLHM and 150Mbps for the ISL71710SLHM
- 1.3mA quiescent current and low EMI with no carrier or clock noise

Visit [renesas.com/radhardplastics](https://www.renesas.com/radhardplastics) for more details.

# REFERENCE DESIGNS

Renesas offers reference designs to help solve our customers' system level application challenges in space-grade systems. For more information, visit [www.renesas.com/space](http://www.renesas.com/space) or contact your local sales office.

## Radiation Tolerant GaN Based Flyback Reference Design

Part Number	ISL71043M
Description	The ISL71043MEVAL1Z evaluation platform is designed to evaluate the ISL71043M and ISL71040M in a flyback power supply configuration. The ISL71043M is a radiation tolerant drop-in replacement for the popular 28C4x and 18C4x PWM controllers suitable for a wide range of power conversion applications including boost, flyback, and isolated output configurations. This evaluation board is a flyback power supply.
Doc Number	R12UZ0044EU0100



ISL71043MEVAL1Z Evaluation Board

## 100V Half-Bridge GaN Power Stage

Part Number	ISL73040SEH, ISL73024SEH, ISL71610M
Description	The ISL73040SEHEV4Z evaluation board demonstrates how to build a half-bridge power stage with the ISL73040SEH low-side GaN driver and the ISL73024SEH 200V GaN FET. The ISL73040SEH has a 4.5V gate drive voltage (VDRV) generated using an internal regulator that prevents the gate voltage from exceeding the maximum gate-source rating of the ISL73024SEH GaN FET. The ISL73024SEH is a 200V GaN FET capable of 7.5A drain current.
Doc Number	UG186



ISL73040SEHEV4Z Evaluation Board

## RTG4 FPGA Development Kit

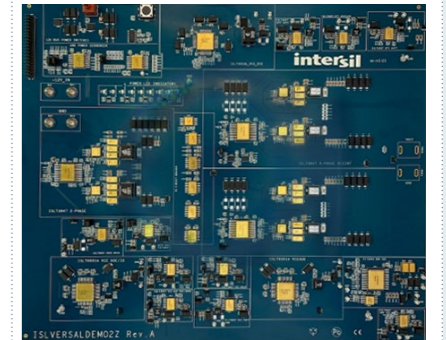
Part Number	ISLRTG4DEMO1ZA
Description	Microchip's RTG4 development platform allow users to prototype and evaluate the FPGA's performance in different applications. The board includes two 1 GB Double Data Rate 3 (DDR3) memories and two 1 GB SPI flash memories. The board also has several standard and advanced peripherals, such as PCIe x4 edge connector, two FMC connectors for using several off-the-shelf daughter cards, USB, Philips inter-integrated circuit (I <sup>2</sup> C), gigabit Ethernet port, serial peripheral interface (SPI), and UART.
White paper number	R34WP0002



ISLRTG4DEMO1ZA

## Power Management for the AMD Xilinx Space Grade Versal™ ACAP AI Core VC1902

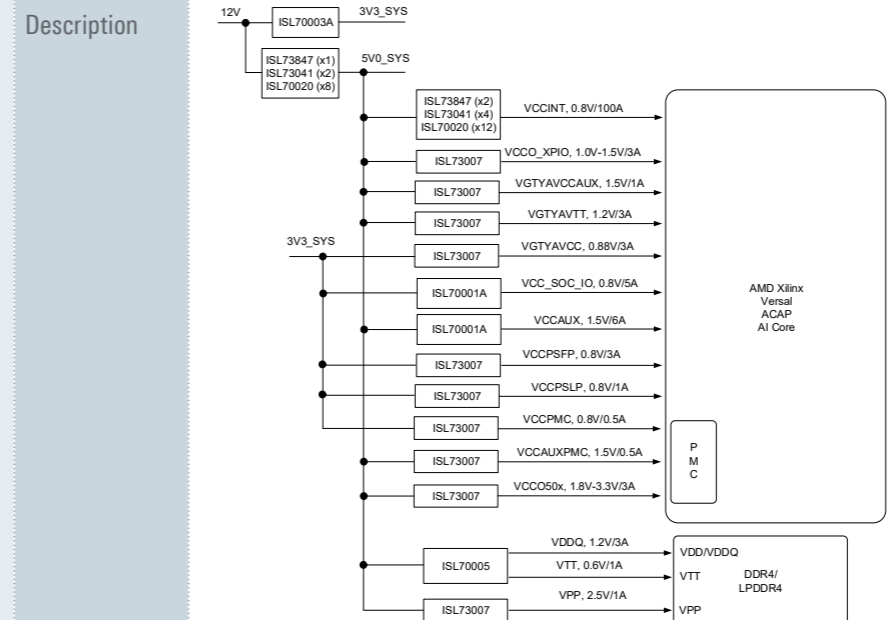
Part Number	ISLVERSALDEMO2Z
Description	The ISLVERSALDEMO2Z evaluation board provides the power management for the AMD Xilinx Space Grade Versal™ ACAP AI Core VC1902 using Renesas' Radiation Hardened Power Management devices. The Versal ACAP system requires various supply rails, including the core, digital, analog and DDR memory. The ISLVERSALDEMO2Z provides all these rails for the user to evaluate the performance against the Versal ACAP DC and AC electrical specifications.



ISLVERSALDEMO2Z

- Radiation hardened QMLV power solution by Renesas (MIL-PRF-38535)
- Designed to power AMD Xilinx Space Grade Versal ACAP AI Core VC1902
- Includes regulators for all VC1902 rails, DDR4 Memory and general +5V/+3.3V bus
- Power Supply Sequencing up and down on all rails

### AMD Xilinx Versal ACAP Full Power Management Specification



### Renesas Radiation Hardened parts used on ISLVERSALDEMO2Z

- ISL73847SEH 12V PWM Dual Phase Controller
- ISL73041SEH 12V GaN Half Bridge Driver
- ISL70020SEH 40V, 65A, 3.5mΩ GaN FET
- ISL70001ASEH 5V, 6A Integrated FET Synchronous Buck
- ISL70003ASEH 12V, 9A Integrated FET Synchronous Buck
- ISL73007SEH 12V, 3A Integrated FET Synchronous Buck
- ISL70005SEH 5V, 3A Synchronous Buck + 1A Source and Sink LDO
- ISL70321SEH Quad Channel Supply Sequencer
- ISL70218SEH Dual 36V Precision Rail to Rail Output Operational Amplifier

Doc Number	R34UZ0015EU0100
Product Page	<a href="http://renesas.com/ISLVERSALDEMO2Z">renesas.com/ISLVERSALDEMO2Z</a>



**Qualification Level**  
 Military = QML Class Q  
 Space = QML Class V  
 Space Lower Level = QML Class T

# SPACE-GRADE PRODUCTS LIST

## Radiation Hardened Analog Products

### Comparators

**Qualification Level**  
 Military = QML Class Q  
 Space = QML Class V  
 Space Lower Level = QML Class T

Part Number	Supply Voltage (V)	Max Input Offset Voltage (mV)	Comparator Type	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temperature Range (°C)	Class	Qualification Level	Package
ISL7119RH	5 to 15	8	Dual	300	-	-	-55 to +125	V, Q, /PROTO	Military, Space	10pin-CFP
ISL7119EH					50				Space	
IS-139ASRH	9 to 30	5	Single or Dual	300	-	83	-55 to +125	V, Q, /PROTO	Military, Space	20pin-CFP
IS-139ASEH					50				Space	
HS-139RH	5 to 30	2	Single or Dual	300	-	-	-55 to +125	V, Q, /PROTO	Military, Space	14pin-CFP, 14pin-SBDIP
HS-139EH					50				Space	

### Interface (RS-422 - Quad Differential Line Drivers)

Part Number	Supply Range (V)	Input Low Voltage Range (V)	Input High Voltage Range (V)	Input Rise and Fall Time (ns)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package
HS-26CT32RH	5	0.8	VDD/2	500	100	-	100	-55 to +125	V, Q, /PROTO	Military, Space Lower Level, Space	16pin-CFP, 16pin-SBDIP
HS-26CT32EH						50				Military, Space	
HS-26CT31RH	5	0.8	VDD/2	500	300	-	-	-55 to +125	V, Q, /PROTO	Military, Space Lower Level, Space	16pin-CFP, 16pin-SBDIP
HS-26CT31EH						50				Space	
HS-26CLV32RH	3.0 to 3.6	0.3 VDD	0.7 VDD	500	300	-	100	-55 to +125	V, Q, /PROTO	Military, Space	16pin-CFP, 16pin-SBDIP
HS-26CLV32EH						50				Space	
HS-26CLV31RH	3.0 to 3.6	0.3 VDD	0.7 VDD	500	300	-	100	-55 to +125	V, Q, /PROTO	Military, Space	16pin-CFP, 16pin-SBDIP
HS-26CLV31EH						50				Space	
HS-26C32RH-T	5	0.3 VDD	0.7 VDD	500	100	-	100	-55 to +125	V, Q, /PROTO	Space Lower Level	16pin-CFP, 16pin-SBDIP
HS-26C32RH					300	-				Military, Space	
HS-26C32EH					300	-				Space	
HS-26C31RH-T	5	0.3 VDD	0.7 VDD	500	100	-	100	-55 to +125	V, Q, /PROTO	Space Lower Level	16pin-CFP, 16pin-SBDIP
HS-26C31RH					300	-				Military, Space	
HS-26C31EH					300	-				Space	

### Transistor Arrays

Part Number	Number of NPN Transistors	Number of PNP Transistors	NPN Gain Bandwidth Product (GHz)	PNP Gain Bandwidth Product (GHz)	Noise figure (50Ω) at 1GHz (dB)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temperature Range (°C)	Class	Qualification Level	Package
ISL73128RH	5	-	8	-	3.5	100	-	-	-55 to +125	V, Q, /PROTO	Space	16pin-CFP
ISL73128EH							50					
ISL73127RH	-	5	-	5.5	3.5	100	-	-	-55 to +125	V, Q, /PROTO	Space	16pin-CFP
ISL73127EH							50					
ISL73096RH	3	2	8	5.5	3.5	100	-	-	-55 to +125	V, Q, /PROTO	Space	16pin-CFP
ISL73096EH							50					

### Sample and Hold

Part Number	Max Acquisition Time (10V Step to 0.1%)	Max Acquisition Time (10V Step to 0.01%)	Maximum Drift Current Over Temperature	PSRR	HDR krad (Si)	ELDR krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temperature Range (°C)	Class	Qualification Level	Package
HS-2420EH	4μs	6μs	10nA	≥80dB	100	100	SEL free	-55 to +125	V, /PROTO	Space	14pin-SBDIP

### Temperature Sensors

Part Number	Linear Output Current (μA/k)	Power Supply Input Range (V+ to V-) (V)	Low Power Consumption at 5V (mW)	50 krad(Si) Low Dose Rate (ELDRS) Shift (°C)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temperature Range (°C)	Class	Qualification Level	Package
ISL73590SEH	1	4	1.5	<1	-	50	86.4	-55 to +125	V, /PROTO	Space	2pin-CFP
ISL71590SEH	1	33	1.5	<1	300	50	86.4	-55 to +125	V, /PROTO	Space	2pin-CFP

### Voltage References

Part Number	Reference Output Voltage	Tempco (Max) (ppm/°C)	Input Voltage Range (V)	Supply Current (μA)	Output Current Capability (mA)	Output Voltage Noise	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package
ISL71091SEH40	4.096V ±0.05%	6	6.0 to 30	300	10 / -5	6.2μVp-p typ (0.1Hz to 10Hz)	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL71091SEH33	3.3V ±0.05%	6	4.6 to 30	300	10 / -5	5.2μVp-p typ (0.1Hz to 10Hz)	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL71091SEH20	2.048V ±0.05%	6	4.2 to 30	300	10 / -5	3.8μVp-p typ (0.1Hz to 10Hz)	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL71091SEH10	10.0V ±0.05%	6	12 to 30	300	10 / -5	14.8μVp-p typ (0.1Hz to 10Hz)	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL71090SEH75	7.5V ±0.05%	10	9.2 to 30	930	20 / -10	1.0μVp-p typ (0.1Hz to 10Hz)	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL71090SEH50	5.0V ±0.05%	10	7.0 to 30	930	20 / -10	1.1μVp-p typ (0.1Hz to 10Hz)	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL71090SEH25	2.5V ±0.05%	10	4.0 to 30	930	20 / -10	1.9μVp-p typ (0.1Hz to 10Hz)	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL71090SEH12	1.25V ±0.05%	10	4.0 to 30	930	20	1.0μVp-p typ (0.1Hz to 10Hz)	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP

### Buffers

Part Number	Wide -3dB Bandwidth	Voltage Gain	Supply Current	Gain Flatness	Gain Accuracy	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package
HS-1115RH	225MHz	+2, +1, -1	6.9mA	±0.1dB	0.99V/V	300	-	SEL Free	-55 to +125	V, Q, /PROTO	Space	8pin-CERDIP

### Current Sources

Part Number	Operating Voltage Range (V)	Output Current	Accuracy (%)	Output Impedance	Applications	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package
ISL73592SEH	3 to 40	1mA	±0.3	14 MΩ	High Side, Low Side, Dual Side	-	75	86	-55 to +125	V	Space	4pin-CFP
ISL73591SEH	3 to 40	100μA	±0.36	189 MΩ	High Side, Low Side, Dual Side	-	75	86	-55 to +125	V	Space	4pin-CFP
ISL70592SEH	3 to 40	1mA	±0.3	14 MΩ	High Side, Low Side, Dual Side	100	75	86	-55 to +125	V, /PROTO	Space	4pin-CFP
ISL70591SEH	3 to 40	100μA	±0.36	189 MΩ	High Side, Low Side, Dual Side	100	75	86	-55 to +125	V, /PROTO	Space	4pin-CFP

### DA Converters

Part Number	Speed	Resolution	LSB Accuracy at 25°C	LSB Accuracy Over Temp	Max Gain Drift (ppm/°C)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package
HS-565BRH	Settles to 0.5LSB in 500ns (Max)	12 bits	±0.125	±0.75	50	100	-	SEL free	-55 to +125	V, Q, /PROTO	Space	24pin-CFP, 24pin-SBDIP
HS-565BEH							50					

### AD Converters

Part Number	Maximum Sampling Rate	ENoB (bits)	SNR (dBFS)	INL (LSB)	DNL (LSB)	HDR krad (Si)	ELDRS krad (Si)	SEL/SEB (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package
ISL73141SEHMFN ISL73141SEHMF7	1MSPS	13.3	82	±1	±0.5	-	75	86	-55 to +125	V Equivalent, /PROTO	Space	14pin-CDFP
ISL73148SEHMF	900kHz	13.4	82	±1.5	±0.5	-	75	86	-55 to +125	V Equivalent, /PROTO	Space	28pin-CDFP

Radiation Hardened Analog Products *(continued)*

**Qualification Level**  
 Military = QML Class Q  
 Space = QML Class V  
 Space Lower Level = QML Class T

**Multiplexers**

Part Number	Multiplexer Configuration	Recommended Supply Voltage Range	Supply Current (max, post-rad)	Transition Time (max, post-rad)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temperature Range (°C)	Class	Qualification Level	Package
ISL73841SEH	Single 32:1 Mux	±10.8V to ±16.5V	±400µA	800ns	-	50	86.4	-55 to +125	V, /PROTO	Space	48pin-CQFP
ISL73840SEH	Single 16:1 Mux	±10.8V to ±16.5V	±350µA	800ns	-	50	86.4	-55 to +125	V, /PROTO	Space	28pin-CFP
ISL71841SEH	Single 32:1 Mux	±10.8V to ±16.5V	±400µA	800ns	100	50	86.4	-55 to +125	V, /PROTO	Space	44pin-CLCC, 48pin-CQFP
ISL71840SEH	Single 16:1 Mux	±10.8V to ±16.5V	±350µA	800ns	100	50	86.4	-55 to +125	V, /PROTO	Space	28pin-CFP
ISL71831SEH	Single 32:1 Mux	3V to 5.5V	+300µA	70ns	-	75	60	-55 to +125	V, /PROTO	Space	48pin-CQFP
ISL71830SEH	Single 16:1 Mux	3V to 5.5V	+300µA	70ns	-	75	60	-55 to +125	V, /PROTO	Space	28pin-CFP
HS-508BRH	Single 8:1 Mux	±15V	+2.0mA/-1.0mA	3µs	300	-	Latch-up free (DI)	-55 to +125	V, Q, /PROTO	Military, Space	16pin-CFP, 16pin-SBDIP
HS-508BEH	Single 8:1 Mux	±15V	+2.0mA/-1.0mA	3µs	300	50	Latch-up free (DI)	-55 to +125	V, /PROTO	Space	16pin-CFP, 16pin-SBDIP
HS-1840BRH	Single 16:1 Mux	±12V±10%	±500µA	1.5µs	300	-	Latch-up free (DI)	-55 to +125	V, Q, /PROTO	Military, Space	28pin-CFP, 28pin-SBDIP
HS-1840BEH					50	V, /PROTO			Space		
HS-1840ARH-T	Single 16:1 Mux	±15V	±500µA	1.5µs	100	-	Latch-up free (DI)	-55 to +125	T, /PROTO	Space Lower Level	28pin-SBDIP
HS-1840ARH					300	-			V, Q, /PROTO	Military, Space	28pin-CFP, 28pin-SBDIP
HS-1840AEH					300	50			V, /PROTO	Space	28pin-CFP, 28pin-SBDIP
HS-0548RH	Single 8:1 Mux	±15V	+2.0mA/-1.0mA	1.0µs	10	-	Latch-up free (DI)	-55 to +125	V, Q, /PROTO	Space	16pin-SBDIP
HS-0547RH	Single 16:1 Mux	±15V	+2.0mA/-1.0mA	1.0µs	10	-	Latch-up free (DI)	-55 to +125	V, Q, /PROTO	Space	28pin-CFP
HS-0546RH	Differential 8:1 Mux	±15V	+2.0mA/-1.0mA	1.0µs	10	-	Latch-up free (DI)	-55 to +125	V, Q, /PROTO	Space	28pin-CFP

**Switches**

Part Number	Supply Voltage Range	Supply Voltage of Specification Limits	Supply Current (max, post-rad)	tON (max, post-rad)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temperature Range (°C)	Class	Qualification Level	Package
HS-303CEH	±15V	±15V	+150µA/-100µA	1000ns	100	50	SEL free	-55 to +125	V, Q, /PROTO	Military, Space	14pin-CFP
HS-303BRH	±15V	±12V	+150µA/-100µA	450ns	300	-	SEL free	-55 to +125	V, Q, /PROTO	Military, Space	14pin-CFP, 14pin-SBDIP
HS-303BEH					50						
HS-303ARH	±15V	±15V	+150µA/-100µA	450ns	300	-	SEL free	-55 to +125	V, Q, /PROTO	Military, Space	14pin-CFP, 14pin-SBDIP
HS-303AEH					50						
HS-302AEH	±15V	±15V	+150µA/-100µA	1000ns	100	50	SEL free	-55 to +125	V, /PROTO	Space	14pin-CFP
HS-201HSRH	±15V	±15V	12mA	80ns	300	-	SEL free	-55 to +125	V, Q, /PROTO	Military, Space	16pin-CFP, 16pin-SBDIP
HS-201HSEH					50	V, /PROTO			Space		

**Op Amps**

Temperature Range: -55°C to +125°C

**Qualification Level**  
 Military = QML Class Q  
 Space = QML Class V  
 Space Lower Level = QML Class T

Part Number	# of Devices/Channels	Bandwidth (MHz)	Slew Rate (V/µs)	V <sub>S</sub> Range (V)	I <sub>S</sub> per Amp (mA)	Noise V <sub>N</sub> (nV/√Hz)	I <sub>BIAS</sub> (max) (nA)	Max Offset Voltage	I <sub>OUT</sub> (mA)	Rail-to-Rail Input/Output	PSRR (dB)	CMRR (dB)	AVOL (dB)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Class	Qualification Level	Package
ISL73444SEH	4	19	60	2.7 to 40	2.4	11.3	650	400µV	10	Yes	123	92	118	-	50	86.4	V, /PROTO	Space	14pin-CFP
ISL73419SEH	4	1.5	0.5	4.5 to 36	0.44	8	15	110µV	43	No	120	120	129	-	50	SEL Free	V, /PROTO	Space	14pin-CFP
ISL73244SEH	2	19	60	2.7 to 40	1.2	12.3	650	500µV	8	Yes	123	92	118	-	50	86.4	V, /PROTO	Space	10pin-CFP
ISL7124SRH	4	1.2	0.4	5 to 30	3	-	400	10mV	10	No	70	70	86	300	-	SEL free	V, Q, /PROTO	Military, Space	14pin-CFP
ISL7124SEH																	V, /PROTO	Space	
ISL70444SEH	4	19	60	2.7 to 40	2.4	11.3	650	400µV	10	Yes	123	92	118	100	50	86.4	V, /PROTO	Space	14pin-CFP
ISL70419SEH	4	1.5	0.5	4.5 to 36	0.44	8	15	110µV	43	No	120	120	129	300	50	SEL Free	V, /PROTO	Space	14pin-CFP
ISL70417SEH	4	1.5	0.5	4.5 to 40	0.44	8	5	110µV	43	No	120	120	129	300	50	SEL free	V, /PROTO	Space	14pin-CFP
ISL70244SEH	2	19	60	2.7 to 40	1.2	12.3	650	500µV	8	Yes	123	92	118	300	50	86.4	V, /PROTO	Space	10pin-CFP
ISL70227SRH	2	10	3.6	4.5 to 36	2.8	2.5	12	100µV	45	No	110	115	120	100	-	86	M, /PROTO	Military	10pin-CFP
ISL70227SEH																	50	SEL free	
ISL70219ASEH	2	1.5	0.5	4.5 to 36	0.49	8	15	110µV	41	No	145	145	143	300	100	SEL free	V, /PROTO	Space	10pin-CFP
ISL70218SRH	2	4	1.2	3 to 36	1.4	5.6	75	290µV	10	No	100	97	115	100	-	86.4	M, /PROTO	Military	10pin-CFP
ISL70218SEH																	50	SEL free	
ISL28417SEH	4	1.5	0.5	4.5 to 40	0.44	8	-	8.5µV	43	No	145	145	143	-	50	73.9	Military (Non-QML)	Standard	14pin-CFP
ISL28227SEH	2	10	3.6	4.5 to 36	2.8	2.5	10	75µV	45	No	117	120	123	-	50	86.4	Military (Non-QML)	Standard	10pin-CFP
HS-0P470AEH	4	8	3	10 to 30	1.375	6	630	2.6mV	10	No	80	80	92	100	50	SEL free	V	Space	14pin-CFP
HS-5104AEH	4	8	3	10 to 30	1.875	6	550	5mV	10	No	80	80	92	100	50	SEL free	V, /PROTO	Space	14pin-CFP, 14pin-SBDIP
HS-3530ARH	1	0.75	0.25	6 to 30	0.16	-	100	5mV	2.5	No	80	80	80	300	-	SEL free	V, Q, /PROTO	Military, Space	10pin-CFP, 8pin-CAN
HS-3530AEH																	50	V, /PROTO	
HS-1145RH	1	300	1000	10	6.5	3.5	25000	10mV	28	No	46	44	92	300	-	SEL free	V, Q, /PROTO	Space	8pin-SBDIP
HS-1135RH	1	360	1200	10	6.9	3.5	25000	10mV	28	No	46	44	92	300	-	SEL free	V, Q, /PROTO	Space	14pin-CFP, 8pin-SBDIP

**Instrumentation Amplifiers**

Temperature Range: -55°C to +125°C

Part Number	Output	BW (MHz)	Slew Rate (V/µs)	V <sub>S</sub> Range (V)	I <sub>S</sub> per Amp (mA)	Noise V <sub>N</sub> (nV/√Hz)	I <sub>BIAS</sub> (max) (ns)	Max Offset Voltage (µV)	I <sub>OUT</sub> (mA)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Class	Qualification Level	Package
ISL70617SEH	Differential	5.5	4	8 to 40	4.3	8.6	25	300	45	-	75	SEL free	V, /PROTO	Space	24pin-CFP
ISL70517SEH	Single-Ended	5.5	4	8 to 40	4.3	8.6	25	300	45	-	75	SEL free	V, /PROTO	Space	24pin-CFP

**CAN Bus Transceivers**

Temperature Range: -55°C to +125°C

Part Number	V <sub>S</sub> Range (V)	Common Mode Range (V)	Max Number of Nodes	Transmit/Receive Bus Speeds Up To (Mbps)	Loopback Feature	V <sub>REF</sub> Output	Listen Mode	Shutdown Mode	Maximum V <sub>THRLM</sub> (mV)	Minimum V <sub>THFLM</sub> (mV)	Minimum V <sub>HYSLM</sub> (mV)	Max I <sub>S</sub> (Listen Mode) (mA)	Max I <sub>S</sub> (Shutdown Mode) (µA)	Maximum Leakage Current (µA)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Class	Qualification Level	Package
ISL72028SEH	3.0 to 3.6	-7 to 12	120	5	No	Yes	No	Yes	-	-	-	-	50	±25	-	75	60	V, /PROTO	Space	8pin-CFP
ISL72028BSEH															100	86.4				
ISL72027SEH	3.0 to 3.6	-7 to 12	120	5	No	Yes	Yes	No	1150	525	50	2	-	±25	-	75	60	V, /PROTO	Space	8pin-CFP
ISL72027BSEH															100	86.4				
ISL72026SEH	3.0 to 3.6	-7 to 12	120	5	Yes	No	Yes	No	1150	525	50	2	-	-	-	75	60	V, /PROTO	Space	8pin-CFP
ISL72026BSEH															100	86.4				

Radiation Hardened Power Products

GaN FETs

Part Number	V <sub>DS</sub> (V)	I <sub>DS</sub> (A)	V <sub>GS(TH)</sub> (Max) (V)	V <sub>GS</sub> (Max) (V)	R <sub>DS(on)</sub> (Typ) (mΩ)	Q <sub>G</sub> (Typ) (nC)	Thermal Resistance Θ <sub>JC</sub> (°C/W)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temperature Range (°C)	Class	Qualification Level	Package
ISL73024SEH	200	7.5	2.5	6	45	14	18.7	-	75	86	-55 to +125	Mod-Class V, /PROTO	Modified Class V	4pin-CLCC
100														
ISL73023SEH	100	60	2.5	6	5	2.5	3.1	-	75	86	-55 to +125	Mod-Class V, /PROTO	Modified Class V	4pin-CLCC
ISL70023SEH								100						
ISL73020SEH	40	65	2.5	6	3.5	19	3.1	-	75	86	-55 to +125	Mod-Class V, /PROTO	Modified Class V	4pin-CLCC
ISL70020SEH								100						

**Qualification Level**  
 Military = QML Class Q  
 Space = QML Class V  
 Space Lower Level = QML Class T

Linear Regulators

Part Number	I <sub>OUT</sub> (Max) (A)	V <sub>IN</sub> (Min) (V)	V <sub>IN</sub> (Max) (V)	V <sub>OUT</sub> (Min) (V)	V <sub>OUT</sub> (Max) (V)	V <sub>DO</sub> @ I <sub>OUT</sub> (Typ) (V)	I <sub>q</sub> (Typ) (mA)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temperature Range (°C)	Class	Qualification Level	Package
ISL75052SEH	1.5	4	13.2	0.6	12.7	0.225	6	100	50	86	-55 to +125	V, Q, /PROTO	Space	16pin-CFP
ISL73052SEH								-						
ISL75051ASEH	3	2.2	6	0.8	5	0.225	11	100	50	86.3	-55 to +125	V, /PROTO	Space	18pin-CFP
ISL73051ASEH								-						
ISL72991RH	1	-3	-30	-2.25	-26	1	6	300	Report Available	SEL free	-55 to +125	V, Q, /PROTO	Military, Space	28pin-CFP
HS-117RH	1.25	4	40	1.25	37	4	N/A	300	Report Available	SEL free	-55 to +125	V, Q, /PROTO	Military, Space	3pin-CAN, 3pin-CLCC, 3pin-TO-257
HS-117EH														

Switching Regulators

Part Name	# of Outputs	Topology	V <sub>IN</sub> (Min) (V)	V <sub>IN</sub> (Max) (V)	V <sub>OUT</sub> (Min) (V)	V <sub>OUT</sub> (Max) (V)	I <sub>OUT</sub> (Max) (V)	Max Duty Cycle (%)	Peak Efficiency (%)	Control Type	Switching Freq. Range (MHz)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package
ISL73007SEH	1	Buck	3	18	0.6	See (EQ1) below	3	See (EQ2) below	95	Current Mode	0.3 to 1	-	75	86	-55 to +125	V Equivalent, /PROTO	Space	14 Ld CDFP
ISL73005SEH	2	Buck	3	5.5	0.6	85% x V <sub>IN</sub>	3	85	94	Voltage Mode	0.1 to 1	-	75	86.4	-55 to +125	V, /PROTO	Space	28pin-CFP
ISL70005SEH	2	Buck	3	5.5	0.6	85% x V <sub>IN</sub>	3	85	94	Voltage Mode	0.1 to 1	100	75	86.4	-55 to +125	V, /PROTO	Space	28pin-CFP
ISL70003ASEH	1	Buck	3	13.2	0.6	85% x V <sub>IN</sub>	9	88	95	Voltage Mode	0.3, 0.5	100	100	86.4	-55 to +125	V, /PROTO	Space	64pin-CQFP
ISL70002SEH	1	Buck	3	5.5	0.6	85% x V <sub>IN</sub>	12	90	92	Current Mode	0.5, 1.0	100	100	86.4	-55 to +125	V, /PROTO	Space	64pin-CQFP
ISL70001SRH	1	Buck	3	5.5	0.6	85% x V <sub>IN</sub>	6	90	94	Current Mode	1 to 1	100	-	86.4	-55 to +125	V, Q, /PROTO	Military, Space	48pin-CQFP
ISL70001SEH													50					
ISL70001ASEH													100					

$$(EQ1) \quad V_{in} * \frac{(t_{PERIOD} - t_{MIN-OFF})}{t_{PERIOD}}$$

$$(EQ2) \quad \frac{(t_{PERIOD} - t_{MIN-OFF})}{t_{PERIOD}}$$

GaN FET Drivers

Part Name	Type	V <sub>IN</sub> (Min) (V)	V <sub>IN</sub> (Max) (V)	Gate Drive (V)	Peak Source Current (A)	Peak Sink Current (A)	Rise Time (ns)	Fall Time (ns)	Prop Delay (ns)	Prop Delay Matching (ns) (Typ)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package
ISL73041SEH	Half Bridge	4.75	13.2	4.5	2/4	4/8	18/14	15/10	29	1	-	75	86	-55 to +125	V Equivalent, /PROTO	Space	16 Ld CLCC
ISL73040SEH	Low Side	4.5	13.2	4.5	3	4	12.5	7.5	40	1	-	75	86	-55 to +125	V, /PROTO	Space	8pin-CLCC
ISL70040SEH											100						

MOSFET Drivers

Part Number	Driver Type	# of Ch	Output Type	Peak I <sub>OUT</sub> (Typ) (A)	Input V <sub>CC</sub> (Min) (V)	Input V <sub>CC</sub> (Max) (V)	Bus Voltage (Max) (V)	Rise Time (Typ) (ns)	Fall Time (Typ) (ns)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package
ISL7457SRH	Low Side	4	Non-inverting	2	4.5	16.5	N/A	23, CL = 1nF	20, CL = 1nF	10	-	40	-55 to +125	V, Q, /PROTO	Military, Space	16pin-CFP
ISL74422BRH	Low Side	1	Non-inverting	9	8	18	N/A	135, CL = 10nF	135, CL = 10nF	-	-	-	-55 to +125	-	Military, Space	16pin-CFP
ISL74422ARH	Low Side	1	Non-inverting	9	7	18	N/A	135, CL = 10nF	90, CL = 10nF	300	-	SEL free	-55 to +125	V, Q, /PROTO	Military, Space	16pin-CFP
IS-2100ARH	Half Bridge	N/A	Synchronous	1.5	12	20	130	60, CL = 1nF	60, CL = 1nF	300	-	SEL free	-55 to +125	V, Q, /PROTO	Military, Space	16pin-CFP
IS-2100AEH											50					
IS-1715ARH	Low Side	2	Complementary	3	10	18	N/A	50, CL = 2.2nF	50, CL = 2.2nF	300	-	SEL free	-55 to +125	V, Q, /PROTO	Military, Space	16pin-CFP
IS-1715AEH											50					
HS-4424RH	Low Side	2	Non-inverting	2	12	18	N/A	75, CL = 4.3nF	75, CL = 4.3nF	300	-	SEL free	-55 to +125	V, /PROTO	Military, Space lower level, Space	16pin-CFP
HS-4424EH	Low Side	2	Non-inverting	2	8	18	N/A	75, CL = 4.3nF	75, CL = 4.3nF	300	-	SEL free	-55 to +125	V, /PROTO	Space	16pin-CFP
HS-4424DRH											50					
HS-4424DEH	Low Side	2	Non-inverting	2	12	18	N/A	75, CL = 4.3nF	75, CL = 4.3nF	300	-	SEL free	-55 to +125	V, Q, /PROTO	Military, Space	16pin-CFP
HS-4424BEH											50					
HS-4423RH	Low Side	2	Inverting	2	12	18	N/A	75, CL = 4.3nF	75, CL = 4.3nF	300	-	SEL free	-55 to +125	V, Q, /PROTO	Military, Space lower level, Space	16pin-CFP
HS-4423EH											50					
HS-4423BEH	Full Bridge	N/A	Synchronous	2.5	12	15	80	65, CL = 1nF	60, CL = 1nF	300	50	SEL free	-55 to +125	V	Space	20pin-CFP
HS-4080AEH											-					

Supervisory

Part Number	Precision Supply Voltage Monitor (V)	Precision Threshold Detector (V)	Independent Watchdog Output	Manual Reset	RST OUTPUT	RST Output	RST_OD	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV/mg/cm <sup>2</sup> )	Temp Range (°C)	Class	Qualification Level	Package
ISL705AEH	4.65	1.25	Yes	Yes	Push-Pull	-	-	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL705ARH														
ISL705BEH	4.65	1.25	Yes	Yes	-	Push-Pull	-	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL705BRH														
ISL705CEH	4.65	1.25	Yes	Yes	-	-	Open-Drain	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL705CRH														
ISL706AEH	3.08	0.6	Yes	Yes	Push-Pull	-	-	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL706ARH														
ISL706BEH	3.08	0.6	Yes	Yes	-	Push-Pull	-	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL706BRH														
ISL706CEH	3.08	0.6	Yes	Yes	-	-	Open-Drain	100	100	86	-55 to +125	V, /PROTO	Space	8pin-CFP
ISL706CRH														



Radiation Tolerant Plastic Products

Rad-Tolerant Analog

Part Number	Description	Isolation Voltage (min)	Data Rate (Mbps)	Output Format	Supply Voltage Range (V)	Propagation Delay	Input Type	ELDRS (krad (Si))	SEL (MeV*cm <sup>2</sup> /mg)	Temp Range (°C)	Qualification Level	Package
<b>CAN Bus Transceivers</b>												
ISL71026M	Rad-Tolerant 3.3V CAN Transceiver, 1Mbps, Listen Mode, Loopback	-	-	-	3 to 3.6	-	-	30	43	-55 to +125	RT Plastic	14pin-TSSOP

Multiplexers

Part Number	Description	Channels per device (#)	V <sub>CC</sub> (Single) (V)	t <sub>AHL</sub> (Max) (ns)	Switch Input Off Leakage (Max) (nA)	Charge Injection (pC)	ELDRS (krad (Si))	SEL (MeV*cm <sup>2</sup> /mg)	Temp Range (°C)	Qualification Level	Package
ISL71030M	Rad-Tolerant 5V 16-Channel Analog Multiplexer	16	3 - 5.5	70	120	5	30	43	-55 to +125	RT Plastic	32 Ld TQFP

Operational Amplifiers

Part Number	Description	Channels (#)	Bandwidth (MHz)	Slew rate (V/μs)	V <sub>s</sub> (Min) (V)	V <sub>s</sub> (Max) (V)	I <sub>s</sub> (per amp) (mA)	Noise V <sub>N</sub> (nV/√Hz)	Offset Voltage (Max) (mV)	I <sub>OUT</sub> (A)	Rail-to-Rail Input	Rail-to-Rail Output	PSRR (dB)	CMRR (dB)	AVOL (dB)	ELDRS (krad (Si))	SEL (MeV*cm <sup>2</sup> /mg)	Temp Range (°C)	Qualification Level	Package
ISL71218M	Dual 36V Precision Single-Supply, Low-power Op Amp	2	4	1.2	3	36	1.4	5.6	0.29	0.01	No	Yes	100	97	115	30	43	-55 to +125	RT Plastic	8 Ld SOICN
ISL71444M	19MHz 40V Quad Low-power Op Amp	4	19	60	2.7	40	1.1	11.3	0.5	0.01	Yes	Yes	130	113	130	30	43	-55 to +125	RT Plastic	14 Ld TSSOP

Voltage References

Part Number	Description	V <sub>OUT</sub> (V)	Tempco (ppm/°C) (max)	I <sub>s</sub> (Typ) (μA)	V <sub>s</sub> Range (V)	Accuracy over temperature/radiation	Output Noise (Typ)	Output Current Capability	ELDRS (krad (Si))	SEL (MeV*cm <sup>2</sup> /mg)	Temp Range (°C)	Qualification Level	Package
ISL71010B25	Ultra Low Noise, 2.5V Precision Voltage Reference	2.5V ±0.05%	10	930	4-30	±0.15%	1.9μV <sub>p-p</sub> (0.1Hz to 10Hz)	20mA	30	43	-55 to +125	RT Plastic	8 Ld SOICN
ISL71010B50	Ultra Low Noise, 5V Precision Voltage Reference	5.0V ±0.05%	10	930	7-30	±0.15%	4.2μV <sub>p-p</sub> (0.1Hz to 10Hz)	930μA	30	43	-55 to +125	RT Plastic	8 Ld SOICN

RF Switches

Part Number	Description	Frequency Range (GHz)	Isolation (dB)	Insertion Loss (dB)	IP0.1dB (dBm)	IIP2 (dBm)	IIP3 (dBm)	ELDRS (krad (Si))	SEL (MeV*cm <sup>2</sup> /mg)	Temp Range (°C)	Qualification Level	Package
ISL71934M	Rad-Tolerant DC-8GHz SPDT RF Switch	DC - 8	67	0.79	32	111	64	30	43	-55 to 105	RT Plastic	16 Ld QFN

Rad-Tolerant Digital

Part Number	Description	Isolation Voltage (min)	Data Rate (Mbps)	Output Format	Supply Voltage Range (V)	Propagation Delay	Input Type	ELDRS (krad (Si))	SEL (MeV*cm <sup>2</sup> /mg)	Temp Range (°C)	Qualification Level	Package
<b>Digital Isolators</b>												
ISL71710M	Rad-Tolerant Active-Input High Speed Digital Isolator	2.5kVrms	150	CMOS	3 to 5	10	High Impedance	30	43	-55 to +125	RT Plastic	8pin-SOICN
ISL71610M	Rad-Tolerant Passive-Input Digital Isolator	2.5kVrms	100	CMOS	3 to 5	8	Passive	30	43	-55 to +125	RT Plastic	8pin-SOICN

Rad-Tolerant Power

PWM Controllers

Part Number	Description	Topology [Rail 1]	Topology	Control Mode	V <sub>DD</sub> (V)	Operating Current (mA)	Start-up Current (Typ) (μA)	Duty Cycle (%)	ELDRS (krad (Si))	SEL (MeV*cm <sup>2</sup> /mg)	Temp Range (°C)	Qualification Level	Package
ISL71043M	Rad-Tolerant Single-Ended Current Mode PWM Controller	Boost, Forward, Single-Ended	Flyback	Peak Current Mode	9 to 13.2	2.9	90	100	30	43	-55 to +125	RT Plastic	8 Ld SOICN, 8 Ld TDFN
ISL71041M	Rad-Tolerant Single-Ended Current Mode PWM Controller	Single-Ended	Flyback		9 to 13.2	2.9	90	50	30	43	-55 to +125	RT Plastic	8 Ld TDFN

Switching Regulators

Part Number	Description	Topology [Rail 1]	Outputs (#)	Input Voltage (Min) (V)	Input Voltage (Max) (V)	Output Voltage (Min) (V)	Output Voltage (Max) (V)	Output Current (Max) [Rail 1] (A)	I <sub>o</sub> (mA)	Switching Frequency (KHz)	Peak Efficiency (%)	SYNCH Capability	Control Type	ELDRS (krad (Si))	SEL (MeV*cm <sup>2</sup> /mg)	Temp Range (°C)	Qualification Level	Package
ISL71001M	6A Rad-Tolerant Sync Buck Regulator with Int. MOSFETs	Buck	1	3	5.5	0.85	4.675	6	1.4	1.18	95	Yes	Current Mode	30	43	-55 to +125	RT Plastic	64 Ld TQFP-EP

GaN FET Drivers

Part Number	Description	Type	V <sub>IN</sub> (min) (V)	V <sub>IN</sub> (max) (V)	Gate Drive (V)	Peak Source Current (A)	Peak Sink Current (A)	Rise Time (ns)	Fall Time (ns)	Prop Delay (ns)	Prop Delay Matching (ns) (Typ)	HDR krad (Si)	ELDRS krad (Si)	SEL (MeV*cm <sup>2</sup> /mg)	Temp Range (°C)	Qualification Level	Package
ISL71441M	Radiation Tolerant 12V Half-Bridge GaN FET Driver	Half Bridge	4.75	13.2	4.5	2/4	4/8	15/10	1.5	29	1	-	30/50	43	-55 to +125	RT Plastic	20 Ld QFN
ISL71040M	Rad-Tolerant Low-Side GaN FET Driver	Low Side	4.5	13.2	4.5	3	4	7.5	1.4	40	1	-	30/50	43	-55 to +125	RT Plastic	8 Ld TDFN

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(Rev.4.0-1 November 2017)

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